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BAILEY REPORTS ON PERENNIAL FORAGE IN DADEVILLE AREA

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Dr. Bennett returns from a journey along the trails of the covered wagon with a narrative, eyewitness account of agricultural pioneering. Out where the West begins—and beyond, to the Pacific—farmers are learning to conserve the riches of the good earth and the bounty that drips from the skies.

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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CONSERVATION ALONG THE OREGON TRAIL

By H. H. BENNETT
Chief, Soil Conservation Service

WE didn't follow precisely the trail of the covered wagons or even in the footsteps of Lewis and Clark. But our zigzagging journey took us back and forth between them on the general course of the Oregon Trail, across prairies, plains, mountains, interior basins, and plateaus, to the Satsop and the lower Columbia. We deviated freely, because we wanted to see various types of farming country, study local problems, and learn what farmers are doing toward their solution.

Along the way we talked with numbers of farmers cooperating in soil conservation district work, conferred with district supervisors, and noted the recovery of grass in Plains areas that were desperately dry, dusty, and barren when I saw them during the disastrous drought of 1936.

We started with the 235,000-acre Turkey Creek Soil Conservation District which sprawls in the rolling country about Pawnee, in southeastern Nebraska. And right away we ran into a demonstration of stubble-mulch seedbed preparation, on the farm of Charles Glasgow. Here were being used a variety of subsurface tillage machines, all recent inventions, most of them a practical aftermath of the joint research studies of F. L. Duley of the Soil Conservation Service and J. C. Russel of the Nebraska Agricultural Experiment Station.

Many farmers were on hand. Obviously they were alert to the importance of this new agricultural practice. We rode with Everett Barr, chairman of the supervisors, as we observed the effectiveness of conservation work in various parts of the Turkey Creek district. Corn on the contour we found to be outstandingly better than that grown where too much of the rainfall had run to waste.

Finally, we came to what someone said was one of

A. H. Sibbernsen and the Chief of the Service examine a seedbed prepared by a subsurface tillage machine. The previous crop of small grain had been combined. Note abundance of straw and stubble left on surface to prevent erosion and to increase absorption of rainfall.

the largest fields of bromegrass in the country. It was a beautiful sight, 640 rolling acres clothed with an unbroken carpet of nutritious grass, seeded on the contour. Erosion was completely under control, and the tract was yielding excellent net returns from the

sale of livestock and seed. This year the seed alone sold for $7,500 cash. How's that for "just grass seed?" Two hundred head of cattle were grazing in the field while we were there—and there was abounding grass for all.

I am convinced that the farmers in the Turkey Creek District, as well as most farmers thereabouts, like the conservation program of the district and the district's democratic way of doing things. What they tell you—and how they tell it—about the saving of soil and water and about increased yields and increased income gives you that impression. And what they have done to expand the district boundaries indicates enthusiastic and continuous approval—pretty nearly unanimous approval.

The district started off with an area of 62,000 acres. Some farmers at first couldn't make up their minds they wanted to be included, so the boundaries were drawn to leave them out. Many of these subsequently petitioned themselves in. Actually, by petition and ballot, 173,000 acres have been added to this district under 28 separate petitions, and there are petitions for still more additions in the making. With that kind of growth—from 62,000 acres to 235,000 acres over a brief period of time—one suspects that the germ of soil and water conservation has found a favorable seedbed in the minds of men tilling the erodible lands of southeastern Nebraska.

After Turkey Creek we spent some time with Duley and Russel themselves, studying their findings on stubble-mulch practices near Lincoln.

Some people find it difficult to understand "research." It may be the word was an unfortunate selection for such a simple endeavor as using human brains to search out new and better and cheaper ways for doing things—such, for example, as making a living out on the land where man must cooperate with his neighbors, his livestock, his plants, his soil, with rainfall and temperature, with tax gatherers, and with nature.

At any rate, Duley and Russel, experimenting with the inter-relationships of soil, water, vegetative cover, and plant growth, have found simple, usable ways to increase vastly the intake of rainfall, and to reduce materially the loss of soil moisture by evaporation. Furthermore, they have developed machines, in cooperation with farm implement manufacturers, which accomplish the subsurface tillage that is requisite to a stubble-mulch system of farming. Still other implements are being developed to improve the seeding of grain and cultivating of corn under this system.

These recent developments, which have counterparts in other regions, represent an epochal advance in the physical aspects of agricultural practice. Stubble-mulch farming completely reverses the old system of turning under all protective covering of vegetation—corn stalks, cotton stalks, wheat stubble, everything. It effectively challenges the "turn under" method which wasted its opportunity to store up rainfall and reduce erosion.

Here are a few reasons why I feel this way of plowing—leaving at least part of the vegetation as a protective cover on the surface—is the right way:

1. At the Clarinda, Iowa, soil and water conservation experiment station the highly important Missouri Valley loessial soil, Marshall silt loam, has been losing by erosion 32 tons of rich topsoil annually from continuous corn land, along with a sixth of all the rainfall, as run-off; whereas, from the same kind of land with a good stand of grass only .02 of a ton of soil has been lost annually, and only one-fiftieth of the rainfall.

2. Under the Duley-Russel system, 54 percent of the rainfall was stored in soil surfaced with 2 tons of straw per acre, and tilled by subsurface methods, as against only 20 percent conserved under ordinary summer fallow and 27 percent under basin listing.

3. Farmers in steadily increasing numbers are adopting this new technique. They like it, I was told, becaue of its value for controlling erosion and because of its good effect on yields and farm income. One farmer has invented and patented an excellent subsurface tillage machine to go with stubble-mulching—a machine which I saw in use on a farm near Broken Bow.

Before leaving the experiments of Duley and Russel, who spent about two hours showing us their work, I want to add another observation about their method of experimentation.

They are making exact measurements of water intake, run-off, etc. on many small plots. From these plots they move whatever shows promise to areas of field size for further checking before making final recommendations to farmers. This plan of carrying the results of investigations from little plots to big plots (field size) and then out into general farm practice—to the point where the farmer harvests his increased or his decreased yields—takes the scientist to the real end of his experiment.

This method of carrying experimental work right up to the farm harvest is the master pattern that governs all investigations of the Soil Conservation Service. It means that our program of research is based on the needs of practical farming; no project is

The Tetons rise majestically from the shores of Lake Jackson.
(Department of Interior photograph)

considered through until the field results are added up.

We saw many phases of soil and water conservation work in a number of districts as we drove westward. There were 30 districts in Nebraska at the time, covering 6,500,000 acres.

Progress was being made everywhere. This year the farmers we talked with were particularly pleased with the better corn being grown on contoured land.

We saw contoured corn on the farm of Albert Watson, one of the supervisors of the Wayne Soil Conservation District, near Wayne, Nebraska. Here the yield was 66 bushels an acre, the best corn ever produced on the place. Contoured Atlas sorgho in an adjacent field was about as dense as a tropical jungle I once got painfully lost in, up on the watershed of the Chagres River, in Panama. The estimated yield of this jungle growth (I mean the sorgho) was 15 tons to the acre—another all-time record for the Watson farm.

There had been some rains to help—some of which had a punch. But the downpours had produced no visible erosion in the contoured fields. In a neighbor's field, however—same soil, same slope, just across the road—while the corn was not so bad—45 bushels—the downhill furrows revealed severe rill erosion between corn rows and heavy loss of rainfall. The soil and water loss in this off-contour field amounted to 21 bushels of corn per acre—or $12 an acre. In both fields hybrid corn was grown.

On the Ginn place, near Bridgeport, Nebraska, an irrigation farm cooperating with the Morrill County Soil Conservation District, one gully, "deep enough to put a house in," produced by improper use of irrigation water, had been filled and planted to a shelterbelt with five rows of trees. The severe erosion that had plagued much of this farm, as the result of long runs of water straight downhill, had been corrected by shortening the runs, rearranging

field boundaries, installing waterways stabilized by vegetation, and including grass-legume mixtures in the crop rotations.

Next day we came to the Thunder Basin land-use readjustment project in the drainage basin of Cheyenne River, north of Douglas, Wyoming. There was a generally good grass recovery on both sides of Big Thunder, as well as in the adjacent Inyan Kara grazing district and on various interspersed parcels of private land. Much of Wyoming was beautifully green. Heavier than average rainfall had helped. Not all the green was grass. Especially was this true on land that had been plowed at one time for wheat. In such old fields at least part of the "blanket of verdure" was Russian thistle. But generally there was some grass, even in the old-field areas, and much good grass on land that never had been plowed. If you had seen this Plains country at the height of the drought in 1936, when everything was parched, you could readily condone such rhapsodic expressions as "a sea of grass stretching to far horizons."

Elmer Spencer ranches in the Thunder Basin grazing district. He, his wife, and young daughter live in an attractive house with good water and a splendid vegetable garden. The road that goes by this way is not paved; it could be said of it that it is "considerable long" via each end. Matter of fact, Spencer lives 60 miles from the nearest town, New Castle, 30 miles from a telephone, 7 miles from his R. F. D. box, 3½ miles from his nearest neighbor, 130 miles from good trout fishing over in the Black Hills. But there are antelope, deer, sage hens, and a vast abundance of elbow room.

Dr. Bennett and Regional Conservator McClymonds observe one of the largest bromegrass fields in the country—500 acres in one stretch. In 1941 the harvest of bromegrass seed on this farm amounted to 100,000 pounds. Some 200 head of cattle were grazing on brome when this picture was taken.

Before readjustments were made through the land purchase program, the Spencers, according to Elmer's version, didn't even have enough elbow room and had no assurance of stability. Uninvited outsiders would push their sheep over on his range land, leased or owned, to eat his grass and drink his stock water. And pay nothing. He never could be sure, under such conditions, that his supply of range forage would carry his stock through a season. Leases were constantly being changed—"and you just couldn't plan anything with any certainty it would be carried out." "Now," he relates, "the Government's purchase of land has made it possible to set up the Thunder Basin Grazing District, and through the work and interest of the district and with developments by the Government, the range is being used according to carrying capacity, the forage is improving, and we finally have protection from trespass grazing and hazardous leases and permits."

Spencer runs 270 head of cattle on the 18 sections of land he owns, leases, or has permit to use.

Next stop was at Walter Peterson's place. Walter was in high humor. We were intending only to meet him, get a drink of water, pass the time of day, and move on; we were already behind schedule. But that didn't suit Walter at all. So during the next two hours we inspected his crested wheatgrass, his contoured corn, his stock ponds, his bins of grain and grass seed, and other things.

His 23 acres of crested wheatgrass had produced 940 bushels of seed. One of his stables was filled with the seed. "And I filled up all my metal bins with

Dr. Bennett talks subsurface tillage with a group of farmers at a Conservation Field Day on the Glasgow farm.

wheat and oats and then when the wife was off guard, I filled up the turkey house. I'll never hear the last of that.

"These conservation boys have saved me. I started contouring in the spring of 1936. I was pretty sick then. All the water that fell on my place was running off and I didn't have sense enough to know it. My two sons—young men they are getting to be, and fine boys—said, 'Dad, you are going deeper in debt every year with this dry farming; we don't want to quit you, but there isn't any future here.'

"Well, that hurt me. I had no answer then. I was going broke farming the old way. I was ready to try anything. And now I have the answer. Contouring has rescued me and my family; we are all happy now. But I still can't understand why I earlier missed the common sense thing to do—plowing, seeding, cultivating on the contour, using strips, building ponds for stock water, grazing the land by its carrying capacity, using the land according to its capabilities.

"I now have over 1,000 head of sheep. In 1934, I had 200 sheep and 15 head of cattle. Now I have 22 head of cattle, 900 ewes, and 500 lambs. Before, I was running sheep all across my range to a waterhole. Now I have several waterholes, located so as to use the range to best advantage. With this improved system of running sheep there's better feed on the range and not so much traveling for the animals to get it. Last year I got half a pound more wool per animal than with the old system of grazing, and this year a pound more. Last year the lambs weighed 4 pounds more than with the old system, and this year 8 pounds more.

"I am getting 4 to 6 bushels of grain more per acre than before. That means $3.50 more an acre, or better. My wheat on the contour will run up to 20 to 25 bushels an acre with a good season like this year; but the old way I got only about 15 bushels at the best."

We finally got back to the road, and we were late getting to bed that night.

Next day we moved on to Devil's Basin Grazing District, up north of Roundup, Montana, on the watershed of the Musselwhite. On one farm they were threshing crested wheatgrass from a 180-acre seeding and getting 70 pounds of seed per acre. This section was hit hard by drought and wind erosion in 1936, and before that the owner of the ranch was on relief, along with some of the neighboring ranchers. Under the land purchase and reorganization program ranching has been combined with farming on this tract—grass farming. The seed was bringing 12 cents a pound and the livestock looked powerfully good in the light of prevailing prices for beef.

Moreover, the crested wheatgrass straw was worth at least $1 a ton, and even more, for feed. Besides that, the 180-acre grass field still had a lot of stubble-grazing in it.

We ate supper at the N-Bar Ranch. The kind of supper that makes you hungry whenever you think of it.

The N-Bar Ranch, cooperating in the conservation program of the Flat Willow Grazing District, runs 500 cattle and about 9,000 sheep on 50,000 acres. (It was near ranch headquarters of this outfit that we passed close to a herd of eight antelope and two coveys of sage hens. There were 18 birds in one covey.)

Later that evening, back at Roundup, a hint of autumn moved in from Canada. We were enjoying the luxury of a merrily blazing log fire when the word "cutthroat" somehow slipped into the conversation. It immediately turned the talk in the direction of fishing and fishing places. Discussion went on and on, but finally boiled down to genuine substance.

Accordingly, next day at noon we set out for Jackson Lake, in the Jackson Hole country over in the Tetons. We were taking leave and retreating to the wilds, remote from all sight and thought of soil erosion of any kind whatsoever.

August had just turned the corner into September. Even so, we ran into a driving snowstorm that continued for an hour. With that sort of weather practically in summertime, I was wondering why in the early days the boys hadn't turned back in the first place when they got that far out on the Oregon Trail. A natural reflection, perhaps, for a Carolinian.

But soon everything straightened out. The road map showed that we were about two miles above sea level, in the Shoshone National Forest. This, the map indicated, was the first of the national forests, established by President Benjamin Harrison, March 30, 1891.

Skirting Yellowstone Lake we looked and listened for trumpeter swans. It was reported that 208 of these birds, which a few years ago came precariously near extinction, had been counted in the Yellowstone.

Next morning we went out on Jackson Lake at an early hour. The fishing was good, cutthroats and mackinaws were striking with thrilling frequency. At first I had some difficulty getting my fish reeled in, but soon got the hang of things and the fish too.

The Tetons were magnificent, even though the higher peaks were cloud-covered most of the first day. We were enjoying the grandeur and majesty of this alluring part of the world, and the solitude and complete isolation from daily routine. Our boat putputted around a point and beyond the point—what do you suppose we saw?

No, it wasn't a bear, it wasn't a moose, or an elk. It was, believe it or not, a detail of CCC boys working on an erosion job!

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Farm pond in Turkey Creek Soil Conservation District, well vegetated with cattails, sedges, slough grass and other native grasses. Trees and shrubs have been planted, and pond fenced to exclude livestock. An ideal wildlife refuge. Water is piped from pond to tank 200 feet below for livestock. The dam provides water for 70 acres of pasture. Drainage area consists of 65 acres under intense erosion control practices such as terracing, grassed waterways, contour farming, residue management, and crop rotations.

CONSERVATION GOES ON THE AIR

By F. A. RANKIN [1]

THIS LAND WE DEFEND! On land, on sea, in the air . . . we Americans are determined to defend our way of life. We defend freedom . . . freedom of speech and religion, freedom from want and fear. We defend our homes, our schools, our churches . . . our fields and our forests . . . and our soil. We will defend our land against invasion—and we are defending our land against an enemy within our borders—soil waste.

Theme music swells to a momentary crescendo, then fades . . .

The United States Department of Agriculture presents another in the series THIS LAND WE DEFEND.

Over eight hundred radio stations in the United States daily employ some millions of watts of electrical energy to send out over the air waves and into the 50 million radio receiving sets the music, drama, and news to entertain and inform the American people. By the time the 1942 plowing season gets under way over half of these stations will have told the story of soil conservation in a new tone of voice, and over 10 million people, from coast to coast, will have heard at least the opening spiel of THIS LAND WE DEFEND.

The stations that broadcast the 10 dramatic shows composing the transcribed series, THIS LAND WE DEFEND, form a potent artery in the system which undoubtedly is one of the most powerful media of information in existence today.

With almost every brand of "drama"—from soap serials to Shakespeare—riding the ether waves week in and week out, it might appear presumptuous that the Soil Conservation Service should attempt to use the dramatic technique to tell its story. Soil conservation might be considered a dry subject. To some people soil conservation smacks of run-off plots, detention dams and diversion ditches . . . erosion conjures up fantastic visions of canyons and gorges, great river deltas, ghost towns . . . the erosion story is too dramatic, it cannot be dramatized convincingly!

Then why did the Soil Conservation Service go in for dramatizing the soil?

There are two reasons: The American people like drama; and soil conservation is a dramatic story.

[1] Division of Information, Soil Conservation Service, Washington, D. C.

That the average American listens to radio drama is evidenced by the fact that the average network station carries a dozen dramatic shows a day. Most of these are 15-minute serials. The radio stage, created by multiple imaginations, has at its command limitless settings where characters and sounds combine to portray the elements in every walk of life and thought. A dramatization is usually a re-creation of a case history. If anything that relates to people is dramatizable, then the story of soil conservation is well suited to dramatization, although six months ago there was some conjecture as to how it would lend itself appropriately to the dramatic technique.

We have a story to tell, a story that gains in significance as the holocaust of war spreads over the earth. We could not tell the whole story, but we could portray the highlights of the erosion problem and the efforts of a democratic people to solve it.

Failing to get the scripts produced as "live" shows, we chose the next best thing—to produce transcriptions. It was an experiment about which we felt some misgivings. We did not know whether we could avoid the pitfalls of under-dramatization and over-dramatization; and once we got under way, we had no assurance that the stations would use this type of transcription.

After the test pressings had been received, we auditioned the shows. Up to this point our chief concern had been production. We had developed no definite plans for distribution, but at the first audition we found at least a partial answer to our problem. Members of the Federal Radio Education Committee attended the audition and immediately asked for platters to distribute to some 2,700 schools throughout the country, schools having play-back systems. An important audience of two million boys and girls had been assured, but we still had to reach the vast adult audience in front of the receiving sets.

Thus it was that, with platters in hand, information men in each of the ten regions set out like traveling salesmen to peddle the shows to leading radio stations in the country. The transcriptions were offered first to the 50,000-watt stations, then to smaller stations. By October 15, the shows had been scheduled on fifty important stations, seventeen of which were of 50,000-watt power. As platters were returned from the first stations receiving them, they were offered to other stations, and so on until they no longer were

usable. We are estimating that before the platters have run their course at least 400 stations will have broadcast THIS LAND WE DEFEND.

We have estimated also that some 10 million people will have heard at least the 75-word opening spiel, which is the same for each of the ten shows. This is how we arrived at this estimate: There are twenty 50,000-watt stations which have broadcast the series. An average of 100,000 listeners for each 50,000-watt station, with 10,000 new listeners each week, adds up to 190,000 listeners, or 3,800,000 listeners in the 50,000-watt areas. (Most 50,000-watt stations have a potential audience of millions.) Two million school children who will hear the shows bring the total to 5,800,000, while the smaller stations—25,000-watt, 10,000-watt, 5,000-watt and smaller—will reach an additional 4 million listeners.

The theme of THIS LAND WE DEFEND is defense against "an enemy within our borders"—erosion. The purpose is to point out in these days of hectic national defense effort the need for constant vigilance in the conservation of our basic natural resources. The series emphasizes the fact that our soil must be conserved in order that the democratic way of life can be maintained, and the emphasis is placed upon conservation in the democratic way.

The entire series was produced under the direction of Shannon Allen, in the studios of the U. S. Department of the Interior. Actors, musicians, sound-effects men and other technicians who worked on the shows are professionals.

The titles to the shows might cause wonder as to where soil conservation comes into the picture—Mormons, Pennsylvania Dutch, Snow Surveys, Beaver, and so on. It looks more like the "Cavalcade of America" than a series of soil conservation shows. These synopses of the scripts make clear the relationship:

The Beaver

This is the story of America's number one conservationist—the "original upstream engineer." The beaver is an agronomist, forester, dam builder, irrigator, canal builder, and lumberjack. When the first settlement was made in America there were more beavers than there now are people in this country. The beaver was a valuable animal. Man went in search of the beaver, up every little stream. He hunted the beaver in every part of the country. By 1900 the beaver was almost extinct. Then man began to realize that a valuable resource was about to vanish. Today we are calling on the beaver to help us with our conservation work. We are using beaver to do flood control work, erosion control work, to restore meadows and to perform other conservation chores.

Dust Storms

Man has misused the Great Plains. Man laid the foundation of the "Dust Bowl." Man's unwise treatment of the land led to unrestricted wind erosion. Man tried to farm land that should never have been farmed . . . tried to farm the way it was done along the eastern seaboard, in small sections. Too much farming, too many people, too many cattle, years of drought, and then . . . DUST. This is the story of man's mishandling of the Great Plains and how we are now going about the job of stabilizing the Dust Bowl.

Snow Surveys

This is the true story of those hardy men who brave the wintry perils of the rugged mountain ranges of the West to survey the snow fields. The snow pack must be measured because the plans of thousands of people in the arid and semiarid West depend upon the mantle of snow and the water in it. Farmers, ranchers, irrigators, power companies, bankers and others, depend on the snow in the high Sierras, the Rockies, the Siskuyous, and the Cascades. The story takes place on the high mountain snow courses where the snow survey party is measuring the "snow crop."

Pennsylvania Dutch

For over 200 years the "plain people" of Pennsylvania have ranked among the finest farmers in the world. This is the story of the Mennonites, Amish, Dunkards, Brethren, and other plain people and their land. The "plain people" have lived close to the soil—and prospered for it. Even in rich Pennsylvania, much of the land has been overworked. Soil erosion has begun to show up on the rolling lands of the "plain people." Erosion has begun to sap the vitality from the soil. Conservative, slow-to-change, yet devoted to the soil, the "plain people" of Pennsylvania have awakened to the danger of soil erosion and are successfully defending their land by terraces, contour cultivation, strip cropping, and other erosion control practices.

The Mormons

Brigham Young led the Mormons west through more than a thousand miles of hardship to establish an ecclesiastical and economic empire in mountainous Utah. The Mormons made the desert flourish. They

built one of the great cities of the world. Where once there was desert now there are trees and flowers, fields of green vegetables and other crops. Where there were wolves and coyotes now there are green pastures and flocks of cattle and sheep. Where there was sagebrush there are fruit trees. Where there were alkali sink holes there are fountains. The Mormons developed one of the finest irrigation systems in the world. They work diligently to conserve their soil and water resources.

The Saga of the Forest

Three hundred years ago there were over 800,000,000 acres of trees in America. This is the story of man's conquest of the forest. In "winning" the continent, man lost much. Millions of acres were shorn of tree and grass. Soil began to move, and with it the vitality of man and the land. But in recent years we have begun to rebuild the soil. We are using billions of trees for erosion-scarred hillsides. Billions of trees to clothe the soil, to stand guard against erosion, floods, and silt.

America's Vanishing Soils

The soils of the earth are like the races of man. There are the black soils, the red soils, the sands, and the yellow clays. Soils vary in color and age and in many other ways, just as the races of man vary. Some are old, some young; some are sturdy and strong; some are thin and anemic. This is a story of how soils are created; how man has mistreated them; how we are today mending our soils.

Soil Conservation Comes of Age

As long as there was plenty of new land to exploit, we paid little attention to erosion. But when new lands no longer lay "just ahead," we were forced to double back on what we had. In recent years men have begun to look closely at their soil, have begun to see that soils are not permanent, that they must be protected. This script traces the soil conservation movement from the days of Washington, Jefferson, and Henry, to the present conservation movement as carried out by farmer-organized soil conservation districts.

Democracy at Work on the Land

This is a dramatization of a soil conservation districts meeting. The board of supervisors discuss various erosion problems in the district—farm planning, terracing, flood control work, reforestation, labor supply, and the like.

Floods

The Ohio flood of 1937 swept away life and property, destroyed homes and hopes, left in its wake a sterile mass of muck and debris. Floods are not new in America. They are as old as the Nation. On the average, over 100 people lose their lives annually in floods—and more than 100 million dollars worth of property is destroyed. This is a story of what American farmers are doing to help reduce the flood damage through the use of soil conservation practices.

CONSERVATION ALONG THE OREGON TRAIL

(*Continued from p. 134*)

Well, well, of all things, how come any erosion way over here in this sort of a situation anyway—was the first query.

It was the same old story. Man had mixed up with Nature, upset the natural balance and, in this case, started shore erosion along the westerly facing banks of both the mainland and the islands. The water level had been raised by installation of a dam by irrigation farmers, and at high water the waves were lashing at the shoreline to reestablish equilibrium farther back from the high-water line. Some islands have been stripped of trees since the construction of the dam and severe toll is being taken of others.

This situation is very much the same as that which developed on Lake George, New York, after the rise in lake level produced by the installation of a dam.

It is not so easy nowadays to get away from man-induced erosion. About the only places left where you don't run into it are the low flats along the Atlantic Gulf Coast and the heavily grassed or forested areas.

But the United States now has its eye on the erosion problem whether encountered along the Oregon Trail, way down in Jackson Hole, or in the cotton fields of Dixie.

That part of the trip west of the Rockies—well, that will have to wait.

The cultivated small fruits, such as blackberries, raspberries, currants, gooseberries and grapes, can be used in single row plantings as contour guide lines and to supply an abundance of table food often lacking in the farm family diet.

PRINCIPLES AFFECTING THE CONTROL OF EROSION IN ROAD CUTS AND ROADSIDE DITCHES

By J. W. JOHNSON [1] and HUGH A. BROWN [2]

COMMON observation has shown that unprotected road cuts and roadside ditches constitute one of the more frequent causes of gully development. Recent data indicate that gullies paralleling roads or receiving drainage from them not only cause much damage to the land, but serve as principal sources of the sediment impairing downstream reservoirs, stream-channel capacities, and agricultural bottomland soils.

A recent survey of the watershed of Lake Issaqueena, developed on Six Mile Creek near Clemson, S. C., in 1938 by the Land Utilization Division for recreational purposes, showed that control of erosion along roads was one of the principal problems to be solved in protecting this reservoir against an excessive rate of silting. A brief study of the character of erosion and transportation of erosional debris to the reservoir led to the conclusions expressed in this article on the principles affecting the control of roadside gully erosion.

Erosion of road cuts, ditches, or even the ordinary gully, generally occurs in two distinct zones, (1) the side slopes and (2) the channel bed. Where steep and barren side slopes are exposed to the direct impact of rain, a considerable quantity of sediment is dislodged and then carried into the bed of the ditch by direct flow or slumping. Once the run-off water is concentrated in the channel, material is transported either by rolling along the bottom or in suspension, depending on the water discharge, the bed slope, and the relative size of the sediment particles. The finer material dislodged from the steep side slopes, mainly by the impact of raindrops (but also by freezing and thawing), moves out of the ditch and either deposits on bordering flatter land or moves on into the larger streams. Usually the bulk of the fine material is transported to the point of deposition by run-off from the same rainstorm that dislodged the material from its original location. On the other hand, the coarser material that ordinarily forms the channel bed is moved downstream at a relatively slow rate, and several storms may be required to move a particular particle out of a ditch.

Erosion plot studies have shown that the intensity of rainfall is more important than the amount of rainfall in determining the volume of erosion losses from surface slopes. In the initial stages of a rain, the impact of the raindrops upon the ground appears to be the most important factor governing the concentration of solid matter in the run-off water. The amount of soil lost from a plot varies approximately with the first power of the slope and the square of the rainfall intensity. To guard against excessive soil loss from roadside ditches and road cuts, it is obviously most important to protect the side slopes from the direct impact of rains. Experience has shown that sodding the slopes or planting kudzu or similar erosion-

[1] Hydraulic engineer, sedimentation division, Soil Conservation Service, Washington, D. C.

[2] Assistant chief, regional farm planning and management division, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

Sloping and planting produced this remarkable transformation of a roadside bank which had been badly eroded by drainage from farm land.

control plants along the crest of cuts, gullies, and ditches generally affords adequate protection. This may be noted in the accompanying photographs.

Unprotected side slopes of road cuts, ditches, and most gullies not only contribute a large amount of finer material which commonly enters the natural stream systems and is transported to downstream reservoirs or other places of deposition, but also contribute much of the coarse material that forms the movable bed in the ditch.

The coarser material making up the bed of a ditch forms an erosion pavement that changes in configuration and thickness only over a period of time. This coarse material, which enters the ditch either from the side slopes or from other sources such as terrace outlets or connecting road ditches, tends to stabilize the ditch bed and to prevent or reduce downcutting. If the slope of the ditch is steep, however, and the volume and duration of flows, because of the size of the drainage area, are great, then the rate of transportation of the bed material will exceed the rate at which the supply of material enters the ditch; then retrogression or downcutting will occur, and will continue until a resistant material is reached, or until the bed slope is so flattened that the velocity of flow decreases and a state of equilibrium with the load is reached.

Just as data from experimental plots indicate the nature of soil losses from ditch side slopes, so do laboratory investigations on the transportation of bed load give information on the movement of the loose granular material that forms the ditch bed. These investigations show that the rate of transportation of such material varies principally with the bed slope and the depth of flow. By reducing the magnitude of these factors, it is practicable to reduce to a minimum the amount of material moved out of a particular ditch. The effective slope of a ditch can be flattened by check dams, and the depth of flow can be reduced either by diverting a portion of the flow or by widening the bottom width. Downcutting will occur only when the bed slope is so great that the amount of material transported out of the lower end of the ditch exceeds the supply contributed by the side slopes and tributary ditches. Control methods that induce deposition in a ditch are generally preferable to those that permit cutting, because objectionable deposits can be easily and inexpensively removed by road scrapers and other equipment, while downcutting, if in advanced stages, may be both difficult and expensive to remedy.

In some instances the supply of coarse material entering a ditch may be reduced or eliminated by protecting the side slopes or by diverting to other channels that material coming from terrace outlets or other ditches. If the supply of coarse material is reduced or eliminated and water is still allowed to enter the ditch in appreciable quantities, the coarse material existing in the ditch at the time of interception continues to move downstream, with the result that the bed is scoured or lowered until a relatively stable slope is reached. If all material is transported out of the ditch, erosion into the underlying subsoil horizons will become active and the effects damaging. Although heavy and stiff subsoils usually are relatively resistant to erosion by water flowing over their surface, and the sediment load from this source in a single storm may be small compared to the load contributed by rain impact upon exposed side slopes, it is of particular importance especially in the southern Piedmont, that erosion be prevented from penetrating through the B horizon into the C horizon, because the

C horizon has, in general, little or no binding qualities and disintegrates rapidly under the action of flowing water.

The primary difference between flow over a sand bed and flow over a bed of stiff soil is that in a sand bed the sand particles move downstream at relatively slow rates, and other sand particles usually are entering the upper end of the channel to replace the material moved out from the lower end. With the more or less constant exchange of material throughout the length of the ditch the position of the bed remains relatively stable so long as there is no great change in outside conditions. In a channel with a bed of stiff subsoil, particles are more difficult to dislodge from the bed, but once dislodged, they are easily transported, and no similar material moving down from upstream sources is able to deposit and take their place. Downcutting and resulting bank cutting will therefore proceed unimpeded.

The logical and practical control of roadside ditches and road cuts for protection against undermining of roadways and adjacent fields and the elimination of these sources of sediment production lies (1) in the protection of steep exposed side slopes by a vegetal cover and (2) in the prevention of any disturbance of the erosion pavement of sand in the channel bed. Drop structures of various designs may be necessary if the bed slope is relatively steep. Channel reshaping in some instances is effective in spreading water laterally and reducing its erosive action. It is undesirable to disturb the sand bed of a roadside ditch by using road scrapers and other equipment, unless certain factors such as road drainage improvement make it imperative to do so. Diverting water from a ditch at frequent intervals into vegetated channels, meadow strips, or heavily vegetated areas, such as a woods, not only serves to reduce the volume of flow which may otherwise become concentrated and cause excessive cutting in the lower reaches of the ditch, but the sediment is trapped and prevented from reaching the main stream.

The accompanying photographs illustrate typical examples of effective erosion-control methods. Of these, sloping and sodding are perhaps the most expensive methods, but the results are considered the most permanent and also present a pleasing appearance. An inexpensive method consists in the planting of kudzu which eventually spreads over even the steepest slopes and gives adequate protection. There are many control methods that can be used, but the important requirement in all such work is to recognize and respect the basic principles governing erosion in order to obtain the most effective control at the least cost.

A PASTURE THAT DOES NOT TAKE "ANNUAL LEAVE"

By GLENNON LOYD [1]

Ed Jeche's Guernsey herd finds abundant succulent feed on this improved pasture in mid-August when most of the meadows in southern Minnesota have not a spear of green in them.

ED G. JECHE, a quiet pipe-smoking farmer living 4 miles east of Spring Valley, Minn., does not join in the chorus when his neighbors lament meager milk production in the latter part of July and in August. He merely smiles and thinks of this 25-acre pasture that doesn't go on "annual leave" and cause his Guernsey herd to let him down. But more of this pasture later . . .

In late summer little rain falls in the southern Minnesota dairy country where Jeche lives, and a

[1] Associate information specialist, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

Ed. Jeche, left, and Jacob H. Janzen, project conservationist, in the 25-acre pasture that provides feed for Jeche's Guernsey herd six months a year. Here graze 18 cows and 16 heifers and calves. The wire cage in the foreground is used to protect a small area from grazing so that estimates may be made of the field's yield in terms of hay.

brilliant sun frequently drives temperatures to the 100° mark. Bluegrass takes a well-earned summer nap, and most of the meadows sprout no more spears of succulent grass than a billiard ball does hair.

This is always a time of fretting for the thrifty farmers of southern Minnesota who do not like to see their cream checks dwindle while waiting for the reviving fall rains to repaint the landscape in a nice shade of green.

Some farmers attribute the decreased milk flow solely to "flies and this blamed hot weather." Others, more discerning, observe that their herds find in the pastures little more than "standing room only." Those inclined to be humorous in spite of adverse conditions refer to their meadows at that time of year as "exercise pens."

Jeche, whose blue-gray eyes reflect his earnestness, for some time has been numbered among those farmers concerned about late summer meadows as well as about soil erosion that was thinning crop yields year by year.

Thus it was that in 1937 this farmer welcomed the opportunity to become a cooperator in the Deer-Bear Creek soil conservation demonstration project that had its headquarters at Spring Valley.

He and the project technicians drew up for his rolling 200-acre place a farm-conservation plan that met not only the erosion problem but also that of adequate summer pasture for his expanding Guernsey herd.

This 63-year-old farmer was as deeply concerned about the soil that had washed away from the land as he was with the lack of pasture. Jeche's father homesteaded the place in 1859 and Jeche was born there in 1878. He did not have to be told that more than half of the topsoil had washed away from most of his hillsides—and hillsides are all you can find on his place. Gullies had begun to sprout up like weeds.

Each November, Jeche observed that he must travel up and down more and more rows before putting the sideboards on his husking wagon. Each August the threshing machine told him that his yields of oats, barley, and wheat were slipping.

It had become harder and harder to get a catch of red clover. Bluegrass alone had failed, and timothy fields with a few sprigs of clover looked pale and thin.

Today the situation is greatly changed. All of Jeche's tilled land is strip cropped on the contour. His 5-year agreement with the Service expires next spring but he says he will never go back to farming parallel with the fence lines—"not after the experience we've had with this."

"I didn't think we would like the strip-cropping," he said, "But we do like it now, and we know it does the land a lot of good. We don't have the washing we had when we worked the land up and down hill."

But this quiet farmer's enthusiasm is most noticeable when he talks up his 25-acre pasture that provides feed aplenty from mid-May until it is blanketed with snow for the winter along in November. He has 18 cows and 16 head of heifers and calves on the pasture for the 6-month period. When they are on the pasture, he does not barn-feed the cows—and he told us that when he finally switches them over to winter feed, he does not experience a jump in butterfat production.

His records disclose that his butterfat production has been on the increase since the pasture began yielding in 1939. His 1938 butterfat production averaged 257 pounds per cow, while in 1940 the average was up to 292 pounds.

Of course, Jeche does not attribute the increasing production to the pasture alone. He does point out quickly, however, that it provides feed for the herd for half the year, and that there is no labor involved for seeding, cultivating, or harvesting crops.

(Continued on p. 145)

Check-Up On Perennial Forage Plants

By R. Y. BAILEY [1]

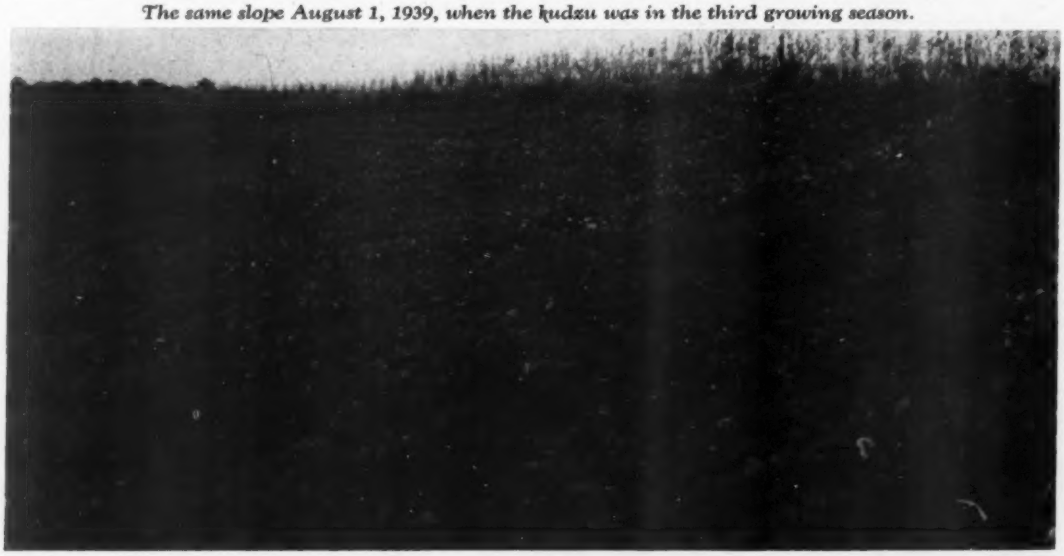
AROUND the last of August, I spent 3 days inspecting the Dadeville, Ala., Demonstration Project Area, with the definite purpose of determining what use farmers were making of the perennial forage crops that were planted while the demonstration project was being developed. Were farmers mowing kudzu and sericea for hay? Were they overgrazing these crops? Were they plowing them up? Were they planting any additional acreage? These were questions that seemed particularly important in connection with this demonstration area where the program was to such a large extent built around perennials.

First, I found that the sericea lespedeza has made

[1] Chief, regional agronomy division, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

Cotton and corn were grown on this steep slope in the coastal plain until the sandy topsoil and much of the subsoil were lost. Kudzu was planted in the spring of 1937 and this picture was made September 8 the same year.

The same slope August 1, 1939, when the kudzu was in the third growing season.



vigorous growth, but is not being utilized as fully as it should be. I saw several farms where sericea was being mowed for hay, but on many others it had not been cut. Farmers who are harvesting sericea hay are well pleased with yields and quality of hay, and it appears that failure to utilize it by others has been due largely to the fact that most farmers in the area do not own mowing machines. It is frequently impossible for them to rent or borrow mowing machines at the time sericea is ready to harvest. Also, the first cutting of sericea hay is ready to harvest at a time when other spring work is pressing. By the time farmers are ready to mow it, the plants are too far advanced for good hay.

In a few places sericea had been plowed up and the land returned to row crops. In all such cases, the crop had not been utilized for hay and, consequently, its value as a forage crop was not appreciated.

As for seed from this perennial, I saw indications that there will be more sericea seed harvested than in any previous year. This was encouraging, as the cash income from this seed may stimulate interest in the plant. It was encouraging also to see steady increase in the acreage of sericea on farms where it was harvested for hay. Much of the seed harvested this fall will be used to plant additional acreage on farms where it has been utilized for hay.

Kudzu has made striking progress during the past 4 or 5 years. I traveled practically all roads in the project area and from almost every hilltop I could see one or more fields of kudzu. Many of these fields had shown little sign of kudzu above the weeds and other vegetation until this year, when it finally outgrew the weeds and produced a dense growth of rich green forage. The abundant rainfall during the summer of 1941 was an important factor in this development. Applications of phosphate made in the spring of 1941 also contributed to the growth of kudzu. The use of phosphate has been greatly increased because of the demand for crowns. A large number of farmers applied phosphate and disked their kudzu in the spring of 1941, in order to sell crowns next year.

The most striking phase of the development of perennial forage crops at Dadeville is the complete transformation of those rough gullied fields the farmers were willing to have planted to kudzu in 1935 and 1936, only because they had no hope of ever using this land for any other purpose. I visited one 39-acre field where a CCC crew spent several weeks in the construction of various types of dams for gully control in the summer and fall of 1934. This field was planted to kudzu in the spring of 1935 and was given little treatment until the spring of 1941, when phosphate was applied and the entire area was disked. The steep slopes of this field, once marked by numerous gullies, are now completely covered by a dense growth of kudzu. Thus this field, that at one time was considered worthless as a result of continued cultivation in row crops, has been restored through better land use to a high state of productivity. If the present ground cover is properly maintained and wisely used, this field will contribute in a very real sense to a permanent agriculture.

Farmers are utilizing kudzu for hay and for temporary grazing. Every area that has made sufficient, growth has been either mowed for hay or grazed. In several instances the stands have been injured by mowing too frequently, while in others overgrazing has resulted in complete destruction of the stands. Most of the overgrazing occurred where tenants fenced small areas and practiced continuous close grazing, although in some cases ownership of land has changed and new owners have fenced portions of the kudzu fields into permanent pastures, with the result that the stands are seriously overgrazed. In general, however, injury by mowing or grazing is less than might have been expected in an area where such a large proportion of the land is farmed by tenants with very little guidance from the absentee owners.

During the inspection tour I saw a few fields of kudzu where farmers had plowed and returned the land to row crops, almost invariably before a complete stand was established. In some instances farmers became impatient with the delay in getting a stand; in others they were afraid kudzu might become a troublesome pest.

After a careful study of the perennial forage plantings in the Dadeville area, I concluded that not more than 5 percent of the kudzu and sericea had been plowed up or destroyed by grazing. This is a remarkably low loss in acreage when it is considered that less than 1 percent of the farmers in the area knew anything about the value of either crop when it was planted on their land, and that much of the land was operated by tenants who knew nothing of the value of either crop. They were interested chiefly in the production of cotton and corn, and under such conditions we might have expected that a much larger acreage of the perennials would have been destroyed.

The new plantings of kudzu made in 1940 and 1941 far outweigh the acreage destroyed by plowing or grazing. Although new plantings have not been

Lespedeza growing on a steep slope in the Piedmont near Gainesville, Ga. The sericea is being cut with a scythe and fed green to work stock, cows, and hogs.

recorded on a project area basis, available records for Tallapoosa and Chambers Counties, where the project area is located, indicate that approximately 2,000 acres were planted to kudzu in the old demonstration area in 1940 and 1941. These new plantings were rather evenly distributed over the area, and I observed many of them during the three days of inspection. In general, the new plantings are on much better land than was devoted to kudzu in the earlier years, and they are being given better cultivation than any of the earlier plantings.

As evidence that the perennial plantings at Dadeville have developed into something of value, a famous canned-milk company, after surveying several counties, decided to locate one of their plants in Dadeville. I was told that representatives of this company stated that the feed production program that had been developed through use of perennials in this area was one of the most significant they had seen anywhere in the country. It appears that the perennial forage being produced on land which farmers had abandoned may be the basis on which a change will be made from a row-crop agriculture to a better balanced type of farming including livestock.

Although time did not permit me to make a careful study of every phase of the program at Dadeville, it was pleasing to note that in several instances farmers had plowed terraces for maintenance during the 1941 summer. This was noticeable on land that had been in small grain in the spring.

Woodland plantings have made striking progress. The growth of pine has been highly satisfactory. Black locust, on the other hand, does not seem to be making as rapid growth as it made during the first few years.

I found that encouraging progress has been made in pasture development during the past 3 years. Excellent pastures are being developed where lowland areas are brushed, limed, fertilized, and seeded.

This report would be incomplete if I did not call attention to a few of the major mistakes that were made at Dadeville. Chief among these was our failure to include sufficient annual lespedeza in the cropping system—this important phase of the vegetative program was not given sufficient attention. Fortunately, this early mistake is being corrected. An increasing number of farmers are growing annual lespedeza on their cropland and it appears that within a few years this important plant will come into general use in the area. The livestock program, in connection with the milk plant, should stimulate interest in annual lespedeza, which will be needed to round out the feed production program that is necessary in a dairy enterprise.

Crotalaria was not given sufficient attention in this area. Although a considerable acreage was planted to crotalaria, we did not use it as extensively as we should. I saw many fields where fair stands of volunteer crotalaria plants were growing as a direct result of seedings made in 1935 and 1936. I believe that crotalaria will come into much more general use, particularly as a cover crop following small grain.

Another mistake in this area was our failure to make more careful selection of land for perennial forage

crops. In the early years at Dadeville, we had very little conception of the principles of land use. Most of our perennials were planted in the effort to get acreage. We did not give sufficient attention to the selection of sites according to the capabilities of the land. The lessons learned at Dadeville during these early years have been reflected in the improved land use in evidence at later projects, CCC camps, and soil conservation districts in Alabama and other parts of the Southeastern region. Largely as a result of what we learned at Dadeville, a large proportion of the perennials that were planted after 1937 were in strips on critical slopes and at other places in fields where they would be most effective for erosion control and soil conservation.

Further improvements can be made as the old project agreements are converted to farm conservation plans with the soil conservation district. It is particularly important that additional acreage of perennials be established so as to avoid destruction of stands through excessive grazing and mowing. It is essential, also, that we make a systematic effort to bring annual lespedeza into the cropping systems for the production of additional forage and grazing and for soil improvement. I believe that an increased interest in farm dairying will develop after the milk plant is established, and that farmers will gradually shift from a row crop to a more protective type of farming.

My observations during the 3 days I spent in making this study lead me to believe that we must make a drastic increase in the acreage of close-growing crops, and a corresponding decrease in the acreage of clean-tilled row crops, before the agriculture in this area can be placed on a safe basis. It is my opinion, after this study, that eventually the acreage of row crops must be reduced by at least 50 percent, if these steep lands are to be used permanently.

On the afternoon of the third day of this study, I was so fortunate as to have Representative Joe Starnes of the Fifth Alabama District with me in the field for a short tour. Mr. Starnes had visited this area when we were starting the demonstration project in the fall of 1934 and he was in a position to appreciate the development of the program during the past 7 years. He was most enthusiastic about improvements through the use of perennial vegetation, and he also expressed himself as being highly pleased with the results obtained from the funds expended at Dadeville.

DOES NOT TAKE "ANNUAL LEAVE"

(Continued from p. 141)

The threshing rig was in the barnlot the day we stopped to see Jeche—"Jake" Janzen, the Spring Valley project conservationist, was with me. But work or no work, Jeche was not too busy to steal away for a short while to tell us about his pasture. While I visited with him, Janzen tossed a load of bundles into the separator.

The Guernseys were grazing contentedly in the pasture and, judging from its appearance, that pasture could have supported the two neighbors' herds for quite a while, along with the Guernseys. The neighbors had just as many acres of pasture per cow, but their grass was "toast" brown.

One must not get the impression that the pasture is the most fertile piece of land on this farm. One part of the farm was so steep and undulating, and so shot full of gullies, that it did not lend itself to contour cultivation—that part is the pasture today. Most of it lies on a 12-percent slope.

In 1938 it was seeded to a new type of pasture mixture with a nurse crop of barley. The mixture was comprised of sweetclover, alfalfa, brome, and timothy. About 5 pounds of each were seeded to the acre.

Yield data taken from the pasture, in cooperation with the agronomy division of the University of Minnesota at St. Paul, tell why Jeche's butterfat production does not slump in the summer. On the basis of 15-percent moisture, the pasture produced the equivalent of 3.66 tons of hay per acre in 1939, 3 tons in 1940 and an estimated 3.19 tons in 1941.

With an electric fence that parallels the main waterway of the farm, Jeche has divided the pasture into two almost equal fields. This makes it possible to manage the sweetclover so that some goes to seed in one of the fields every year. Otherwise, he switches the stock from one side to the other so as to keep both parts properly grazed.

This year the pasture did its intended job just as well as it did last year and the year before, and there is no prospect that it will slow up. As a backstop, however, Jeche depends on the three fields adjoining the pasture. Since two of them each year are in hay as a part of the crop rotation for the farm, they are ready for supplemental pasture duty, if needed.

How valuable a good pasture can be in sudden emergency was demonstrated to Jeche on July 10, 1940, when he was completely "hailed out." His record book shows his yields for corn and small grains as all zeros. The pasture, beaten into the ground by the hail that denuded most other vegetation, recovered within a week.

PHOTOGRAPHIC METHOD OF PREPARING FARMER-DISTRICT AGREEMENT MAPS

By W. F. BEAMON and M. S. KENNEDY [1]

Working by the new method.—Typical enlarging and developing room.

Working by the old method.—Typical drafting room.

THE Soil Conservation Service has established photographic service at each of the regional offices. The units are attached to the Regional Cartographic Divisions. They are equipped to make cartographic reproductions as needed in our soil conservation program, but their main responsibility is to reproduce photographic maps for use in the Farmer-District Cooperative Agreements.

When plans for the district program were concluded, a meeting was held in the Washington office to discuss the proposed organization and a method of handling the work. During this meeting a quota was established for the number of Farmer-District Agreements that the field men would be expected to sign up each month.

On the basis of this quota the staff of the Cartographic Division attempted to work out their plans so that they would have sufficient draftsmen available to draft the maps for the Farmer-District Agreements by the same method they had been using for the Farmer-Project Agreements.

It was immediately apparent, however, that to handle this number of drawings by the old method it would be necessary to add several hundred draftsmen to the force. Furthermore, upon investigation it was found that such a large number of draftsmen, with the necessary qualifications for this type of work, were not available. To secure enough men for this work it would be necessary to initiate a large training program; it would be expensive and it would delay the program. With these serious problems confronting them the staff members of the division decided to attempt to devise a new process by which the output of the force could be increased and the need for training such a large number of draftsmen could be eliminated.

Many suggestions were offered, but the final decision to try out a method whereby the farmer-agreement maps could be reproduced photographically came about as a result of the fact that the Department of Agriculture already had available aerial photographs for about 75 percent of the farm lands in the United States.

It was proposed that, first, the physical surveyor would make a land evaluation survey on aerial photographs, at a scale of 4 inches to 1 mile, in the same way as in the past. When a farm had been selected for planning the conservation-survey photograph of the individual farm would be enlarged by the photographic laboratory to the desired planning scale (usually 8 inches to 1 mile); and, at the same time, a plain aerial photograph on the same scale would be made for the planner to use as a base on which to plan the farm. The conservation-survey photograph was to be colored to show use capabilities and used as the planner's guide. After the farm was planned in

[1] The authors are cartographic engineers, cartographic division, Soil Conservation Service, Washington, D. C.

pencil on the aerial photograph, the Cartographic Division was to ink in this plan, in a finished drafting style, and then the photographic laboratory would make the required number of copies of the land-use and use-capability maps for inclusion in the Farmer-District Agreements.

It was decided that, before adopting an idea so radically new, a complete test would be made to learn whether or not the photographic method was feasible and practical. In September 1938 this test was conducted in the Western Gulf Region of the Soil Conservation Service. This region was selected because of the farms ranging from small units, intensively farmed, to large range units. This region also had available all the necessary laboratory equipment for such a test. For the test, ten typical farms were chosen from various parts of the region, and completed agreement maps for them were reproduced by both processes, while very accurate time and cost records were kept for each step.

As a result of this test it was found that the cost of reproducing the Farmer-District Agreement maps by the photographic process was slightly less than by the drafting method. As the photographic process had just been started it was thought that these costs would be reduced further as the personnel became more proficient in the method. To date, although the cost varies slightly in the different regions, this original cost has been cut almost in half by streamlining the process and designing more efficient equipment.

The test brought out numerous advantages of the photographic process. The most important of them are enumerated below:

1. This additional work can be carried on with the present force of draftsmen and the addition of only a few photographers.

2. The farmer can understand a map drawn on the aerial photographic base more easily than a hand-drawn line or symbolized type of map.

3. The amount of drafting is greatly reduced when the work is performed on an aerial photographic base that already shows all of the physical features of the farm.

4. The aerial photograph makes an ideal base for the physical surveyor to use in determining his land use capabilities.

5. Coloring indicating these capabilities can be easily superimposed on the conservation survey copy without covering up the field work.

6. At group planning meetings it is possible to furnish each farmer with an aerial photograph of his own farm on which all physical features are clear and understandable.

7. It greatly shortens the time needed to deliver the finished agreement maps to the planner.

8. Copies of the agreement maps can take greater reductions and still have the same degree of legibility.

9. The reduced size of the map makes possible a much better arrangement of the agreement.

After a report of the test was submitted to the Washington office it was decided that the photographic process would be adopted. On January 4, 1939, a Field Memorandum was issued authorizing the setting up of a laboratory for this work at each regional office and establishing a procedure for making Farmer-District Agreement maps by the photographic process.

Steps were taken immediately to determine the proper photographic and reproduction equipment needed to carry on the work. After thorough consideration of all types of photographic equipment on the market, and after a few pieces of new equipment had been designed especially for this work, photographic laboratories were set up at all of the regional offices.

These laboratories have been operating for the past several months and, although some of the regions still are not signing agreements to their full capacity, yet it is gratifying to know that during the past year they have turned out a large amount of work. The following tabular statement will give some idea of what this work involves:

Aerial Photographs

Negatives developed	146,280
5″ x 7″ Photographs printed	5,616
8″ x 10½″ Photographs printed	568,944
16″ x 20″ Photographs printed	20,340
20″ x 24″ Photographs printed	38,472
Misc. add. sizes printed	69,384

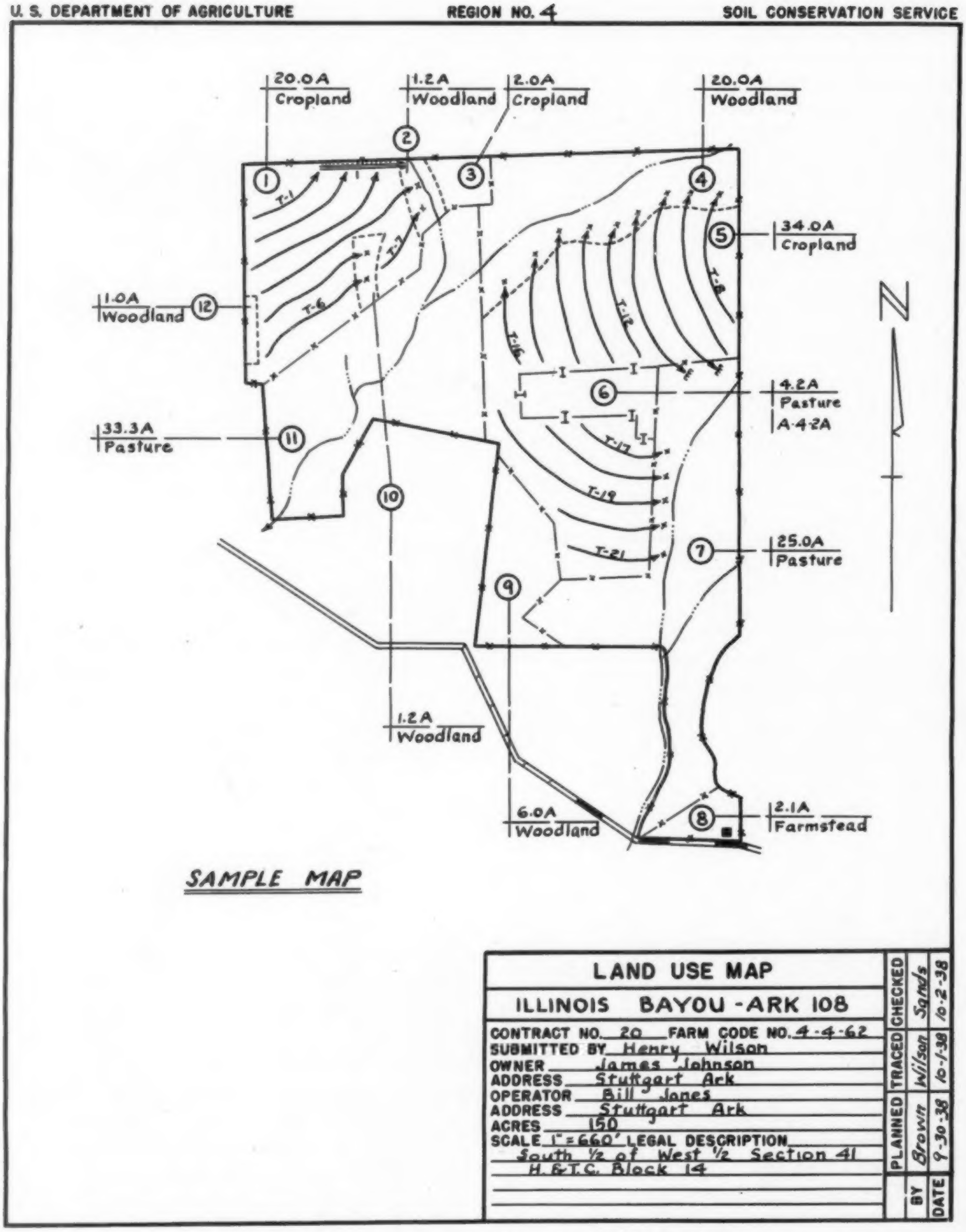
This work serviced approximately 60,000 farms throughout the entire United States.

General Visual Photographs

Negatives developed	36,288
5″ x 7″ Photographs printed	172,440
8″ x 10½″ Photographs printed	15,444
11″ x 14″ Photographs printed	1,884
16″ x 20″ Photographs printed	1,236
20″ x 24″ Photographs printed	624
Misc. add. sizes printed	11,520

Although primarily these laboratories were set up to reproduce photographic agreement maps they were found to be extremely valuable for many other uses. For example, they produced last year approximately 1,345,957 square feet of Ozalid prints; 165,502 square feet of photostats; numerous trans-

(*Continued on p. 149*)



Typical land-use map made by the drafting method

Typical land-use map made by the photographic process.

(*Continued from p. 147.*)

parencies, blueprints, vandykes, derma prints, and other types of reproductions that were necessary.

At the time these laboratories were set up very little thought was given to national defense. Recently however, information has been received from the War Department that, if emergency arise, these laboratories will be called upon to do photographic work in connection with defense. Fortunately they are all thoroughly equipped and staffed with experienced men, and could, if necessary, exert their entire efforts to defense of the country. Already several of them are spending part of their time on work having to do with national defense.

A Double Check On Erosion

By M. E. MORTIMORE [1]

ESTIMATES of the volume of soil losses as well as the degree of erosion are important in connection with planning conservation programs for flood control, and for protection of reservoirs, stream channels, etc., against damages by sedimentation. Volumetric estimates previously made from standard conservation surveys did not prove to be entirely satisfactory and led to a research study of special survey techniques by the Sedimentation Division in cooperation with the Physical Surveys Division.

This paper gives the results of application of parts of these experimental techniques, which are not yet published, to two portions of the Little Sioux River watershed in northwestern Iowa where a double check on erosion was made by comparing the volume of sediment accumulation with soil losses under two widely different physical conditions.

One of these checks (unit 1) was made on an alluvial fan from a 114-acre watershed about 3 miles northwest of Correctionville, Iowa, along the Little Sioux River Valley. The conservation survey showed a soil loss of 71.7 acre-feet and the sedimentation survey showed 69.8 acre-feet of sediment accumulation. Another check (unit 2) was made approximately 2 miles west of West Okoboji in an old lake bed and on the adjacent slopes. The soil loss indicated by the conservation survey was 54.6 acre-feet and the volume of sediment accumulated in the lake basin was 52.5 acre-feet. Since no soil was carried out of unit 2, and only a minor quantity, mostly very fine or colloidal material, beyond the fan in unit 1, a reasonably accurate comparison of erosion and deposition could be made. The results of these studies indicate the accuracy that may be obtained in some areas by the conservation survey, supplemented by the additional measurements of erosion described below, in determining the extent of soil losses by erosion.

Soil erosion.—The volume of soil loss by sheet erosion in both of these studies was measured on the regular detailed conservation survey maps. (See figs. 1 and 2.) The area in acres in each erosion class was multiplied by the average thickness of soil lost

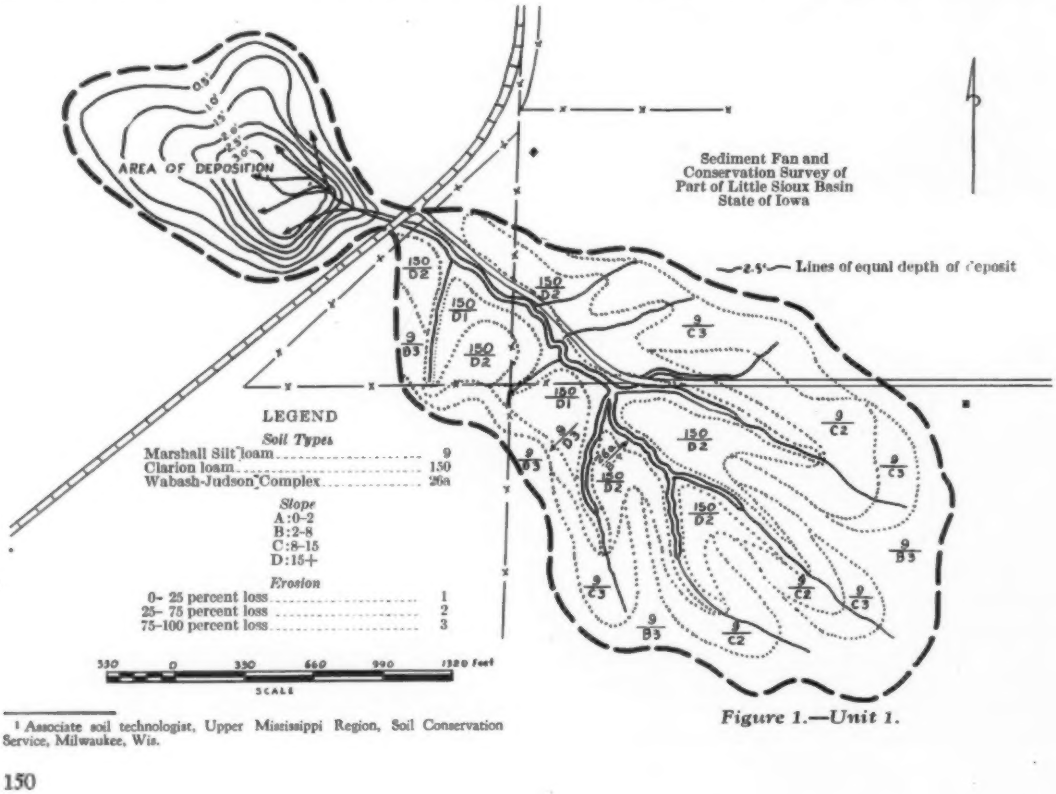


Figure 1.—Unit 1.

[1] Associate soil technologist, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

within these classes and the result indicated in acre-feet. An average depth of 12 inches for virgin soil was used in unit 1, and 10 inches in unit 2. The total volume of soil loss by sheet erosion in unit 1 was 49.7 acre-feet and from the second unit, 54.6 acre-feet, as shown in the accompanying table.

The volume of sediment coming from gully and road-side erosion was determined by measuring the cross-sectional area at frequent intervals and computing the volume for the linear distance between these cross-sections. The total volume of sediment coming from gully and roadside erosion in unit 1 was 22.0 acre-feet. In the second unit, the erosion was all classed as sheet erosion, since the water concentrations were in the form of rills not yet having reached the gully stage.

Table showing comparison of erosion losses and sediment deposits on alluvial fan and old lake basin, Little Sioux watershed, Iowa

	Unit 1	Unit 2
Area affected:	*Acres*	*Acres*
By deposition	56.3	30.0
By erosion	93.9	60.0
Total	150.2	90.0
	Percent	*Percent*
Percent of deposition	37	33
Percent of erosion	63	67
Volume of sediment:	*Acre feet*	*Acre feet*
From gully and roadside erosion	22.0	0.0
From sheet erosion	49.7	54.6
Total erosion	71.7	54.6
Total deposition	69.8	52.5

Distribution of modern deposit.—The volume of modern deposit was determined by making frequent borings on the fans and within the old lake basin. Lines were drawn through points of equal sediment depth with intervals of 0.5 foot (figs. 1 and 2). The area in each zone between these depth lines was measured and the volume of sediment determined by multiplying this area, in acres, by the average sediment depth.

The depth of the deposit on the alluvial fan, unit 1, thickens from the outer edge to the center, where the stream divides into numerous distributaries (fig. 1). The depth of deposit in the old lake basin, unit 2, thickens from the outer edge to the center (fig. 2).

The valley deposits are narrow along each tributary, within the small valleys of the small watershed, unit 1, up to within approximately 700 feet of the divide.

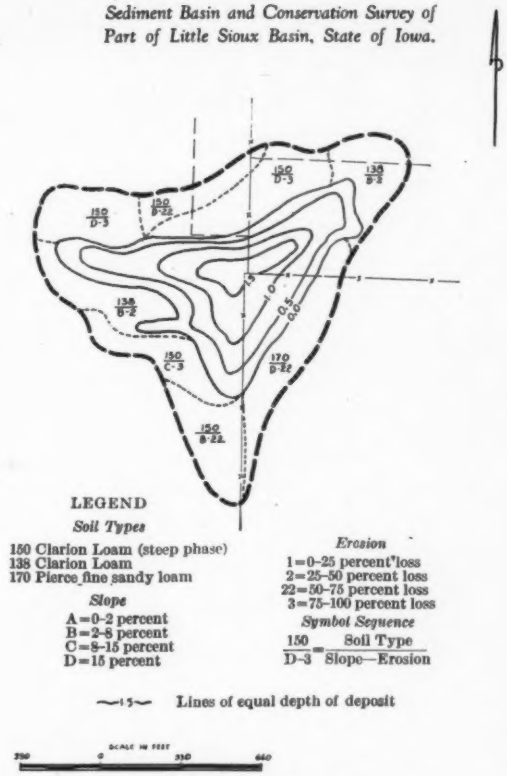


Figure 2.—Unit 2.

The average thickness of the deposit increases from 0.2 foot at the upper ends of the tributaries to 1.8 feet at the lower end of the main valley just above the road. The volume of sediment in these small valleys was determined by making borings across the valleys at frequent intervals and computing the volume for a valley reach between cross-sections.

These data were gathered by field survey methods, similar to those being developed in watersheds above reservoirs by the Sedimentation Division in cooperation with the Division of Physical Surveys.. The results show in a general way the relation between erosion and deposition and have value in determining sediment sources in relation to areas of sediment damage. It is also shown that the volume of erosion loss can be measured in some areas with reasonable accuracy by special conservation survey techniques.

Where market conditions justify planting of spruce or pines for Christmas tree production, single row contour plantings can be expected to produce very well shaped trees.

BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neall Faris

LEGUMES FOR EROSION CONTROL AND WILDLIFE. By Edward H. Graham. Miscellaneous Publication No. 412, U. S. Department of Agriculture. Washington, D. C. 1941.

Had you been around certain Service offices when Graham's "Legumes" appeared in final form you would have heard the concerted "It's here at last!" that arose even before the book had been inspected for details. We have known for over two years that the volume was in the making, and we have needed it for much longer than that. Happily, it more than meets our expectations, and already the small green volume has found its place on the shelf closest at hand.

"Legumes for Erosion Control and Wildlife" is announced and reviewed in some detail in this department because without doubt the book is valuable to many other people far removed from Washington offices where an authoritative reference is an important part of equipment. Needless to say it is the only book listing and describing those species of the Leguminosae known to have some significance in connection with conservation of soil and wildlife. Not until recent years was there any widespread realization of the importance of leguminous plants in a Nation-wide program for the control of erosion and the protection and preservation of wildlife. Today the picture is entirely different. Farmers everywhere are enquiring about this or that erosion-control plant for one or another reason; highway and drainage engineers want legumes for bank protection; game managers and biologists—as well as farm women who love the flash of bluebirds' wings over the fence rows—want wildlife cover and food plants so that wild creatures will come and use them for habitats.

Biologists—Mr. Graham among them—have done much within the past decade to help along the soil and water conservation program by making studies of wildlife food plants and correlating their findings with the findings of erosion control research. Such correlation of facts points directly to the land, the farm in particular, where the farmer will recognize as a heaven-sent boon the plant that if used properly will provide him with fine forage, will improve his soil merely by being grown on that soil, will cure old gullies and prevent new gullies from starting, and at the same time will help create a refuge for the wildlife he wants on his land.

This book is, in fact, built around the interdependence of soil, vegetation and wildlife; it is intended to be used, was written, compiled, and published because of the need for it. Mr. Graham in his 20-page Introduction gives the facts, descriptive, historical and otherwise, about the Leguminosae, and it is so well done that the reader and user of the book forgets all about the old wornout line so frequently drawn in the attempt to separate the scientific from the popular or "for-the-million" style of writing. The Introduction is no less valuable than the lists and descriptions which make up the larger part of the book, because at this stage of conservation knowledge and activities it is important that those who use legumes acquire a clear understanding of the reasons for doing so. Farmers in particular should have the benefit of known and proved facts about the characteristics of different species, their economically valuable products, their nitrogen-fixing qualities and why certain of them should be used in rotations, their disease susceptibilities and resistance, how to choose species for erosion control and wildlife, and the steps to be taken in establishing a stand of the desired legume and how to maintain it in good condition after it is established. All these important facts are explained and discussed in the first part of the book so that using the descriptions of individual species becomes a simple matter.

Approximately four hundred species are included in the carefully selected List of Legumes. Some of them—those already widely used for soil improvement and control of erosion—are treated with much detail; these include clovers, vetches, alfalfa, lespedezas, sweetclover and locust. Common names are given and listed alphabetically so that one finds no difficulty in locating the description, and for identification a set of 127 fine drawings, the work of Soil Conservation Service artists, is included at the end of the descriptions of individual species. The drawings also are arranged alphabetically. Suppose, for example, that you have heard people talking about the legume, white sweetclover, and want to know its characteristics, uses, and what it looks like. You will find it in the list of common names, with its scientific name *Melilotus alba;* then you will find its description among the M's in the main part of the book, and from this point you are guided to an illustration showing the plant itself.

Another useful feature of the book, especially for wildlife managers or farmers desiring to establish special wildlife habitats on their farms, is the list of almost three hundred animals and birds and the leguminous plants that each is known to use as food. This list works both ways, provided the person using it is willing to go to a little trouble to cross-check: favorite wild creatures may be encouraged, or those not wanted may be discouraged by eliminating their food plants as far as possible from the local habitats.

CONSERVATION

Conservation is not a program but a point of view. It is not a plan but a guide to planning. If we conserve effectively, conservation must be a broadly permeating motive that influences the use and handling of our natural resources, of our time and effort, and of our opportunities.

A current opportunity that we must not waste is the chance to use the assistance of the Soil Conservation Service and the Agricultural Adjustment Administration and other agencies to maintain or improve soil fertility and water supplies. Both fertility and water resources are essential sources of net income, of food supplies, of health and comfort, and of future happiness and security. The Extension Service must use this opportunity not only to conserve the soil but also to make true thrift a personal and family habit.—K. F. Warner, Extension Service, Washington, D. C.

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For REFERENCE

Compiled by ETTA G. ROGERS, Publications Unit

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[1] From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

The Oregon Trail

The treaty for the purchase of Louisiana Territory was signed in 1803. The ink was barely dry when President Jefferson sent Meriwether Lewis and William Clark to explore the newly purchased land—to note where vegetation would best support settlement and establish overland routes to the Oregon country. Other explorers followed, sometimes in the footsteps of Lewis and Clark and sometimes zigzagging back and forth to find shorter routes and gentler slopes for the covered wagons of the settlers who were to follow. Gradually their paths merged into the Oregon Trail.

Then came the pioneers with their trains of covered wagons. Just a hundred years ago the first group set out on the 2,400-mile trek to the Pacific. Of the 500 that enrolled, all but 69 were discouraged by tales of the hardships that lay ahead. More followed the next year, and the Great Emigration of 1843 included a thousand men, women, and children. Thereafter a continuing stream of emigrants passed over the Oregon Trail.

Caravans assembled at Independence or Council Bluffs, followed the North Platte across the Plains to South Pass, descended into the Great Basin, crossed the divide to the desert along the Snake River, and pressed on to the Oregon country. From the trading centers along the Trail farmers and cattlemen spread out in search of more fertile lands and fresh pastures. Life was hard along the Oregon Trail, but the reward was rich. Many of the pioneers lived to see Oregon admitted to statehood and the Louisiana Purchase converted into a vast inland empire.—*Lois Olson.*